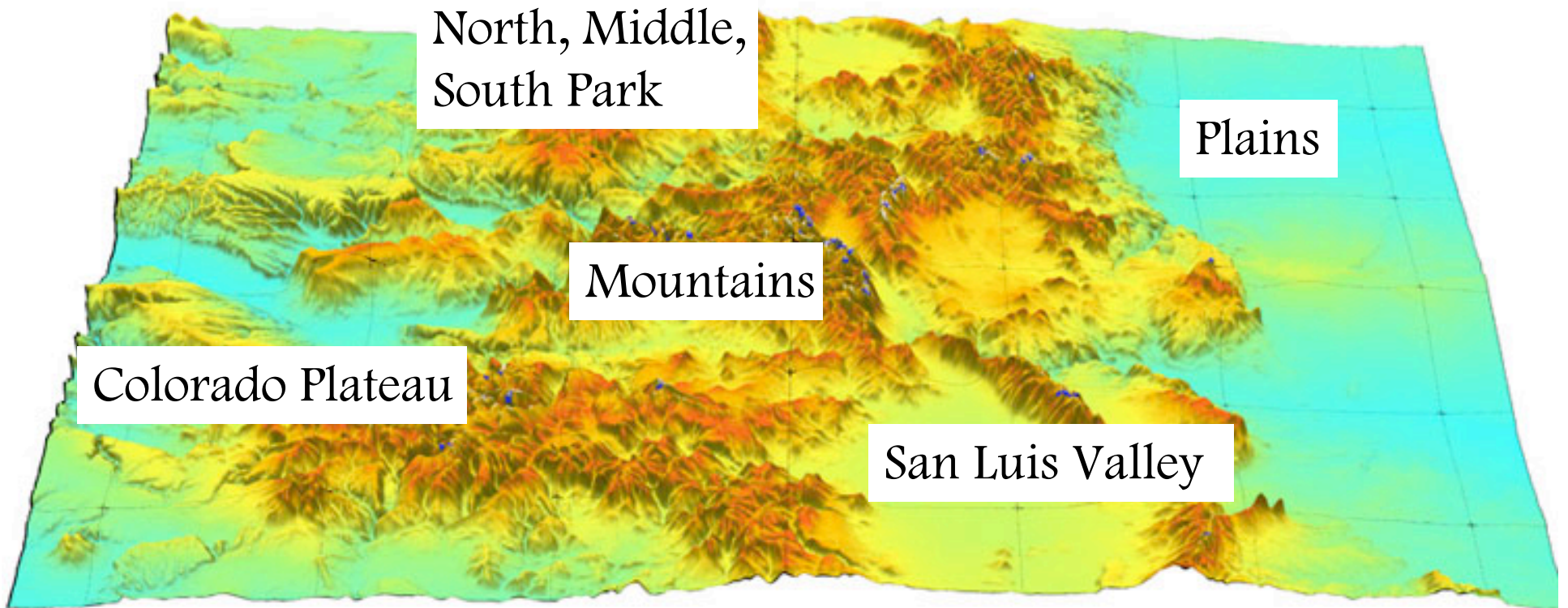
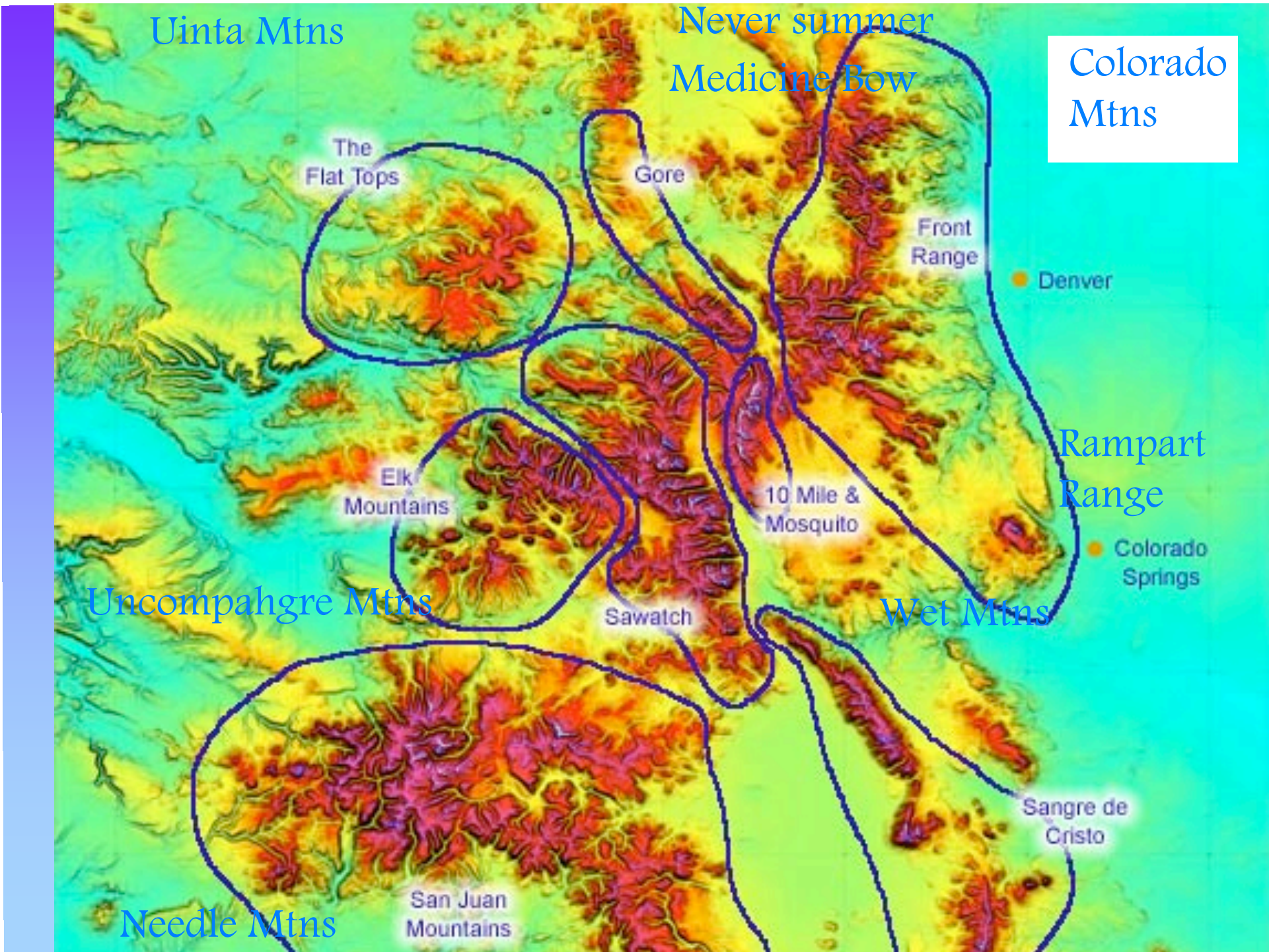


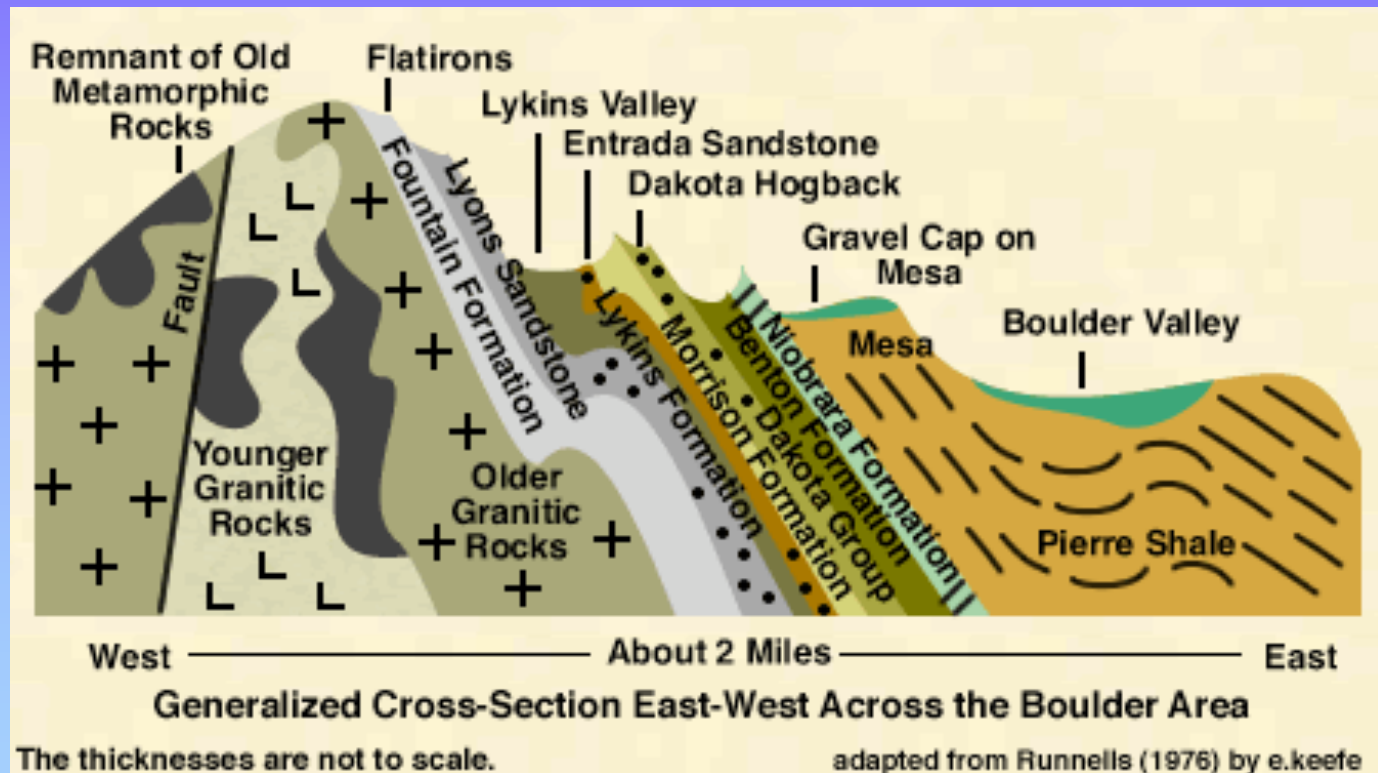
# *COLORADO MOUNTAINS*



**Graphic created by Eduardo Iturrate at Research Systems, Inc.**



# Boulder Area Stratigraphy



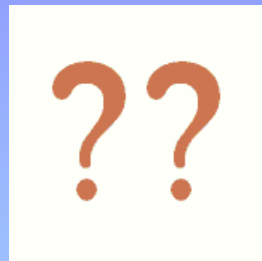
Be able to reproduce this figure on test!

# BASEMENT ROCK



- Emplaced 1.4-1.7 Gy
- Crystalline rock
- Black Canyon of the Gunnison: 1.7 Gy dark gneiss cut through by lighter 1.4 Gy granite and pegmatite
- Underlies most of present day Colorado Rockies

# GREAT UNCOMFORMITY



- An unconformity is when formations of different ages lay on top of each other
- Another way to say this is that part of the geologic record is missing
- From 1.2 Gy to 500 My the geologic record is missing

# TROPICAL SEAS RETURN



- 500 to 330 My
- Sawatch sandstone from beach sands (near Glenwood Springs)
- Leadville limestone deposited
- Missing in Boulder area

# FRONTRANGIA: 300 My



- Ancestral mountain range
- 35 miles west of Boulder.
- Streams carried eroded sand and pebbles from the Ancestral Rockies, dumping the material in wide deposits of gravel.
- These debris would later become the Flatirons!

# FOUNTAIN FORMATION: 270 My



- Arkose sandstone, gravel deposits
- Sharp, angular points
- Iron oxidation, red color
- Good climbing
- Remnants of FrontRangia
- Little transport
- Flatirons, Red Rocks park, Roxborough State Park



# LYONS FORMATION: 250 My



- 220' thick
- Well-sorted, fine sand
- Old sand dunes
- Main building material for CU-Boulder
- Sea began to creep in from the east
- Arid to west

# LYKINS FORMATION: 240 My

- Red color, soft, consisting mostly of shale, sandstone, and siltstone.
- 675' thick,
- Broad, flat floodplains

# Entrada Sandstone: 150 My

- A desert environment with widespread sand dunes once again
- 30' thick
- Cross-bedded
- Much more developed (thicker) around Moab

# MORRISON FORMATION: 140 My



- Broad, swampy lowlands, floodplains
- Lake and stream deposits, mostly clays, Volcanic ash, Wild colors
- Massive amounts of dinosaur fossils; has been described as a bone yard.

# MORRISON DINOSAURS A HOAX

- Fossils from the DNM quarry represent a water-transported and processed assemblage, not an in situ ecosystem.
- The "mass accumulation" of dinosaur bones at DNM, a sort of trademark feature for the Morrison Formation in the American West, represents a mystery that lacks satisfactory explanation.
- Clams, snails, and dismembered dinosaurs within the same deposit demonstrate a watery catastrophe. (Noah's ark flood?)
- <http://www.icr.org/pubs/imp/imp-370.htm>

# DAKOTA FORMATION: 135 My



- shoreline of the Cretaceous Western Interior Seaway, massive sea to the east
- Lots of dinosaur tracks, but few fossils
- Mostly sandstones, some shales, 320' thick
- First hogback (resistant ridge)

# NEXT 70 My

- marked by several advances and retreats of the sea.
- The deposits associated with these episodes of marine flooding consist of shale, sandstone, limestone, and some beds of coal.
- The environments suggested by the rocks include the deep sea, sandy beaches, and coast swamps.
- Names applied to the various formations are (from oldest to youngest): the Benton Shale, Niobrara Limestone, Pierre Shale, Fox Hills Sandstone, and the Laramie Formation. Together these formations total over 10,000 feet of sediment.

# PIERRE SHALE



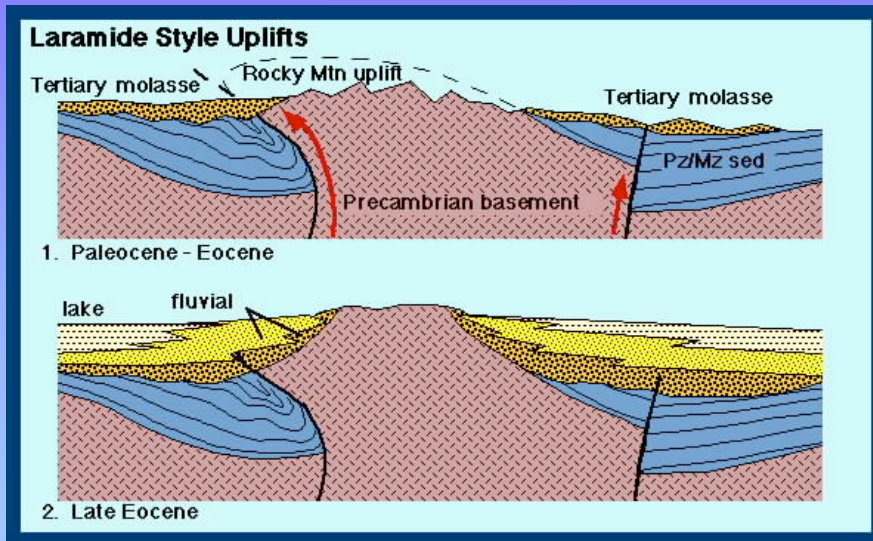
- Up to 9,000' thick
- Deposited by an inland sea
- Lots of dinosaurs, such as this pterodactyl
- City of Boulder built on Pierre Shale



## 70 My

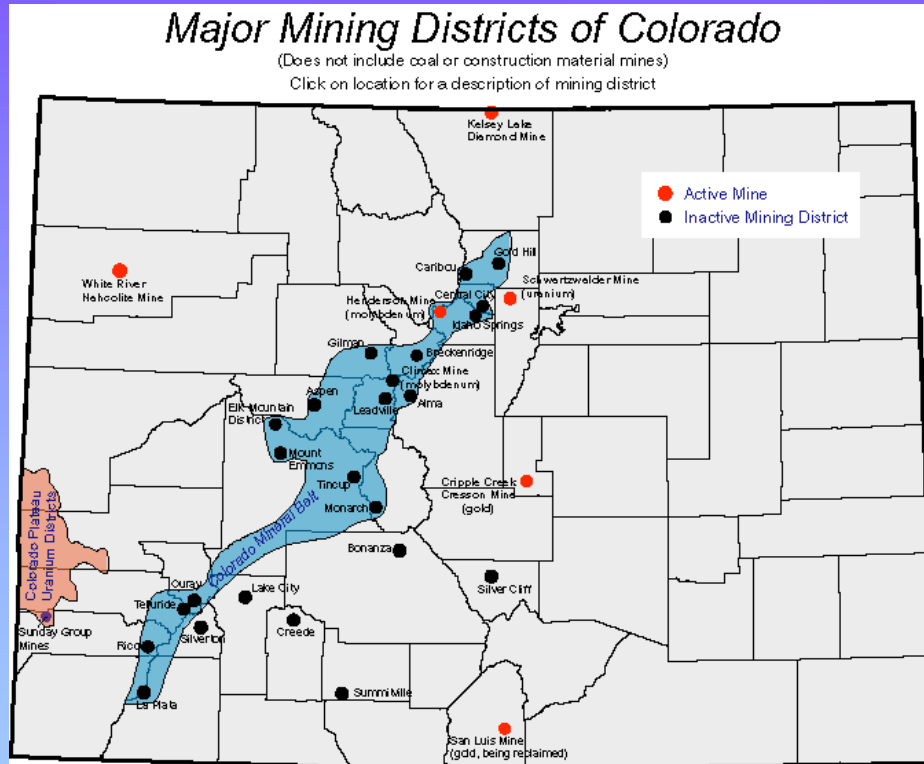
- 70 million years ago, the sea slowly withdrew to the northeast.
- It left behind vast swamps, from which the coals of the Laramie Formation formed.
- Explains natural gas deposits in Denver Basin
- The withdrawal of the sea took about 10 to 15 million years.

# LARAMIDE OROGENY



- 70-40 My ago
- High angle thrust faults, Reverse fault
- Uplift of Precambrian basement
- Deformation of overlying Paleozoic & Mesozoic sedimentary rocks, eg Fountain Formation, Lyons Formation

# Colorado Mineral Belt



- Emplaced during Laramide Orogeny and during volcanism immediately afterward
- Hydrothermal emplacements caused formations of mineral veins
- Almost all mineral at high elevation

# SAN JUAN VOLCANICS

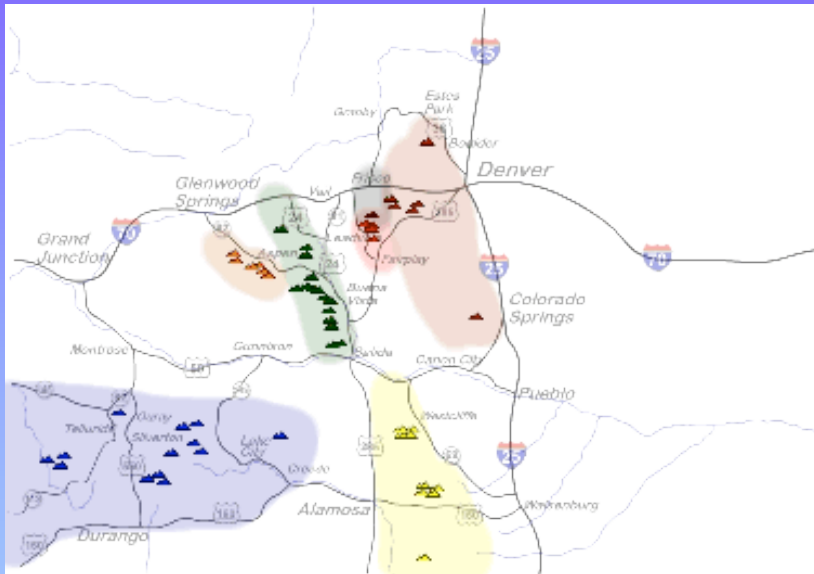


- Ash-flow eruptions in the SW corner of state about 30 My
- Silverton Caldera
- Formation of San Juan mountains

# EPIEROGENIC UPLIFT

- 28 My to present
- Broad, regional uplift with little tilting
- 10 My really kicked into gear
- Still continuing

# THE BIG DOME



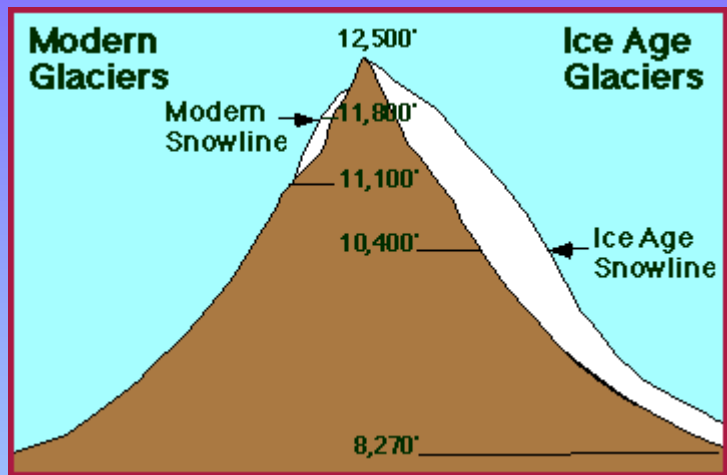
- Uplifted all of western and central Colorado
- Reason so many 14'er
- Dome is centered under near Leadville
- Center of 14'ers
- Antecedent rivers invigorated: Black Canyon, Gore River, Roaring Fork, Royal Gorge
- Rivers flow in radial pattern from dome: North Platte, Colorado to west, Arkansas to south, South Platte to east

# RIO GRANDE RIFT



- Also 28 My-present
- Runs south-north
- Cuts across previous faults
- Forms San Luis Valley, Arkansas River graben
- Continues on to Wyoming
- Still growing
- May connect in future to the Gulf of California

# PLEISTOCENE ICE AGE



- 1.5 My to 12,000 yrs
- Glaciated down to about 8,000' elevation
- Glacial erosion shaped modern mountains